MINISTRY OF AGRICULTURE, LIVESTOCK & FISHERIES

SMALLHOLDER DAIRY COMMERCIALIZATION PROGRAMME

MODULE I

QUALITY ASSURANCE GUIDE FOR DAIRY FARMERS
This guide is intended to assist dairy farmers to produce quality and safe raw milk that complies with regulatory and market requirements through the application of Quality Assurance Systems in milk production.

Like any other business, a dairy farmer should aim at meeting or surpassing their customers’ expectations by providing high quality and safe raw milk that can be handled and processed into high quality and safe milk and milk products.
ACKNOWLEDGEMENTS

The development and production of this guide was made possible by the Smallholder Dairy Commercialization Programme (SDCP) which is a joint development project between the Government of Kenya (GOK) and the International Fund for Agricultural Development (IFAD). The emphasis of the programme is on commercialization of dairy and dairy products through the Market Oriented Dairy Enterprises (MODE) approach.

The programme covers nine counties namely Nakuru, Trans Nzoia, Uasin Gishu, Bomet, Nandi, Bungoma, Kakamega, Nyamira and Kisii. The goal of the programme is to increase the incomes of poor rural households that depend substantially on production and trade of dairy products for their livelihoods by:

- Improving the financial returns of market oriented production and trade activities by small-scale operators, through improved information on market opportunities, increased productivity, cost reduction, value adding and more reliable trade relations

- Enabling more rural households to create employment through, and benefit from, expanded opportunities for market-oriented dairy activities, as a result of strengthened farmer organizations.

Through the facilitation of SDCP, Kenya Dairy Board (KDB), a statutory organization established by an Act of Parliament, the Dairy Industry Act Cap 336, and in partnership with the Kenya Industrial Research and Development Institute (KIRDI) and
Dairy Training Institute (DTI) developed this guide to assist dairy farmers to establish and benefit from a Quality Assurance System (QAS) in milk production.

The following institutions are acknowledged for their participation and contribution to the development of this guide:

(1) **Smallholder Dairy Commercialization Programme (SDCP)**

   - Moses Kembe
   - Michael Kibiego

(2) **Kenya Dairy Board (KDB):**

   - Dr. Philip Cherono
   - Evans Mwangi
   - Paul Ndung’u
   - Kituto Kitele
   - Mildred Kosgey

(3) **Kenya Industrial Research and Development Institute (KIRDI)**

   - George Wanjala

(4) **Dairy Training Institute, Naivasha**

   - Samuel Kamau
   - Catherine Wangila
Kenya has a well-developed dairy industry with an estimated production of 5.2 billion litres of milk per year. This is derived from a dairy herd population of approximately 4.2 million improved dairy animals, 9 million zebus, 12 million goats, and 900,000 camels (Ministry of Agriculture, Livestock & Fisheries, 2016). Cattle account for approximately 88% of the production.

The Kenyan dairy industry contributes approximately 12% and 4% to the agricultural and National Gross Domestic Products (GDP) respectively. It also provides livelihoods for approximately 1.8 million smallholder dairy farmers. The dairy value chain creates approximately 750,000 direct jobs across the value chain in milk production, transport, bulking, cooling, processing and marketing. The support service industry generates an additional 500,000 jobs.

Milk production is an integral and important step in the dairy value chain. The bulking of raw milk from the smallholder dairy farmers facilitates the efficient marketing of quality raw milk to milk processing companies and other buyers. The quality and safety of raw milk is critical to the production of quality and safe milk products that comply with regulatory requirements and meet the requirements of consumers.

Adoption of Good Manufacturing Practices (GMP) and Quality Assurance Systems (QAS) in raw milk production provides dairy farmers with the opportunity to enhance compliance to quality and safety requirements and also derive better income from the sale of raw milk.

The Government of Kenya has continued to support the development of the Kenyan dairy industry by creating a
conducive policy and regulatory environment, investing in infrastructural development and capacity building of stakeholders among others. Specifications for raw milk and processed milk products have also been developed to guide the industry towards compliance and enhanced market access.

IFAD has continued to be a key partner in the development of the Kenyan dairy industry. Their support and goodwill have contributed to increased productivity of milk, better organization and efficiency of stakeholders and increased value addition by the Kenyan dairy industry.

We hope that this guide will be of value to dairy farmers and other stakeholders in adopting best practices and QAS that will lead to improvement in the quality and safety of milk and milk products.

__________________________  _______________________
Moses Kembe                  Margaret Kibogy
Programme Coordinator        Managing Director
SDCP                          KDB
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<tr>
<td>DTI</td>
<td>Dairy Training Institute</td>
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<td>GAP</td>
<td>Good Agricultural Practices</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GOK</td>
<td>Government of Kenya</td>
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<td>GMP</td>
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<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
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<td>KDB</td>
<td>Kenya Dairy Board</td>
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<td>KIRDI</td>
<td>Kenya Industrial Research and Development Institute</td>
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<td>MODE</td>
<td>Market Oriented Dairy Enterprises</td>
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<td>QA</td>
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1.1 Purpose

The purpose of this guide is to assist dairy farmers to produce quality and safe raw milk that complies with regulatory and market requirements. These requirements include the physical, chemical and microbiological specifications for raw milk as provided by the relevant Kenyan standards.

The Quality Assurance framework provided in this guide will assist dairy farmers to implement hygienic milk production practices, establish preventive and control mechanisms, undertake self-assessment of their operations and maintain proper quality records.

It should be noted that this guide is not exhaustive but only meant to provide basic understanding, principles and practices for implementation of a Quality Assurance System at the dairy farm level.

1.2 Objectives

The guide will enable dairy farmers to produce quality and safe raw milk by:

(a) Understanding the quality and safety requirements in milk production
(b) Adopting best practices in milk production
(c) Understanding the causes of poor quality raw milk
(d) Identifying and adopting preventive and corrective actions for quality management
(e) Establishing and administrating quality assurance self-assessment tools
(f) Undertaking proper documentation


1.3 Scope

This guide covers primary production of cow milk from milking, handling and storage at the farm level. Aspects related to animal husbandry practices, personnel and equipment requirements are addressed where relevant to the quality and safety of raw milk.

Figure 1: The Dairy value chain

![Dairy value chain diagram](image)

1.4 Structure

The guide is presented in four chapters covering the following in raw milk production:

(a) Introduction to Quality Assurance Systems
(b) Quality and safety requirements of raw milk at the farm level
(c) Application of Quality Assurance in milk production
(d) Self-assessment guidelines to evaluate Quality Assurance Practices (QAP) in milk production
CHAPTER TWO: - INTRODUCTION TO QUALITY ASSURANCE SYSTEMS IN MILK PRODUCTION

2.1 **What is quality?**

Quality is the totality of features and characteristics of a product or service to satisfy the stipulated needs and requirements of the users.

Raw milk is primarily intended for processing into dairy products which meet specified standards. Therefore, the quality and safety of raw milk is important in the production of high quality milk products.

2.2 **What is Quality Assurance?**

Quality assurance (QA) is a management method that is defined as “all those planned and systematic actions needed to provide adequate confidence that a product, service or result will satisfy given requirements for quality and be fit for use” (ISO 1994).

In raw milk production, QA entails identification, implementation and documentation of relevant activities that will lead to production of quality and safe milk that complies with statutory and market requirements.

2.3 **What is Quality Assurance System?**

Quality Assurance Systems are tools to help enterprises to operate more effectively and efficiently and comply with product or service specifications and requirements. They help to ensure that at every step of operation a minimum standard of defined quality is met for a product or service.
At farm level, such systems help in establishing methods and practices required to consistently produce quality and safe raw milk that complies with statutory and market requirements.

In practice, there are several types of QAS that are applicable in dairy farming such as:

- ISO 9001 Quality Management System
- ISO 22000 Food Safety Management System
- Hazard Analysis Critical Control Points (HACCP)
- Good Agricultural Practises (GAP)
- Total Quality Management (TQM)

These systems have basic principles of Quality Assurance which include:

- Design and scope of the system
- Management commitment and responsibility
- Systematic analysis and systematic action
- Process approach
- Customer focus
- Record keeping and documentation
- continuous improvement

This guide has adopted these principles to present a simple QAS that can be adopted and implemented at the farm level.
2.4 Components of a Quality Assurance System

The components of a QAS in a dairy farm can be grouped into three levels, namely;

(a) The top level commitment by the dairy farmer to meet statutory and market requirements in production of raw milk
(b) The operational level which involves establishing, implementing and documenting methods and practices for assuring production of quality and safe raw milk.
(c) The assessment stage where the effectiveness of the QA system in meeting the desired goals is evaluated and remedial actions to improve the system are instituted.

2.5 Steps in implementation of Quality Assurance Systems

Generally, the implementation of a QAS in the food industry would entail the following steps
(a) Identification of the quality and safety goals of the product
(b) Identification of the activities required to produce and meet the stated quality and safety goals of the product
(c) Identification of the most likely problems that may occur and which affect the quality and safety of the product
(d) Establishment of control mechanisms to reduce the likelihood of the problem occurring
(e) Identification and implementation of remedial actions to manage the problems if they occur
(f) Establishment of documentation and records requirements
(g) Identification and implementation of the quality assessment mechanism

2.6 Documentation requirements in a Quality Assurance System

Documentation is any written text document used to explain some attributes of an object, procedure or process. Documentation is an essential part of the QAS. It provides the control measures and actions that need to be implemented and also documents the various activities undertaken in the production of a good or service, their inter-relationship, characteristics and operating parameters.

The documents required in a QAS are summarized in figure 3 below;
(a) **The Quality Assurance Manual (QAM):**

Is the first level of documentation in a Quality Assurance System. The QAM clearly identifies the product and the processes that affect the quality of the product.

The manual also describes:

- The farm or business
- The scope of the QAS
- The farm’s quality policies and commitment to produce quality products
- The product and its specifications
- The processes involved in the production of the product

The QAM for a dairy farm will among other things provide a brief profile of the farm or business, the commodity addressed (raw milk), the product quality objectives and the processes involved in production of raw milk.
(b) **Quality Assurance Procedures**

Quality Assurance Procedures (QAP) are vital in quality management system. They establish processes that identify the activity, establish what to look for in that activity based on a certain reference, acceptance criteria and the records to keep. They are simplified step-by-step sequence of activities or course of action that must be followed in the same order to correctly perform a task.

In a dairy farm, QAP are required for the following actions among others;

- Sourcing of farm inputs
- Dairy cow management
- Cleaning and sanitization
- Control of non-conforming products
- Control of records

(c) **Standard Operating Procedures (SOP):**

Are step-by-step instructions compiled to help workers carry out routine operations. SOPs aim to achieve efficiency, quality output and uniformity of performance. SOP’s in milk production ensure personnel follow the correct procedures and cover the following activities among others

- Feeding
- Milking
- Cleaning of equipment, containers and utensils

(d) **Quality Records:**

Are the documented evidences that processes are executed according to the QA plan and requirements. Such records in a dairy farm include:

- Milk production records
- Animal health records
• Equipment maintenance records
• Pest management records
• Staff training records

Figure 4: Importance of quality records

Records in a dairy farm are important for the following reasons
• Accountability of operations
• Compliance with legislative requirements
• Quality improvement
• Management planning and decision making
• Communication to stakeholders

2.7 Importance of QA systems in milk production

A well designed and implemented QA system at the farm level will have the following benefits:

(a) Increased confidence by customers on the quality and safety of raw milk
(b) Enhanced access to reliable and premium markets that facilitate value addition of high quality milk and milk products
(h) Protect consumers from possible hazards or risks associated with raw milk such as zoonotic diseases and veterinary drug residues among others.
(i) Demonstrates management commitment to production of quality and safe raw milk that meets customer requirements
(j) Reduction of post-harvest losses of milk resulting from spoilage and rejections by buyers

(k) Overall contribute to increased operational efficiency and profitability of the dairy farm enterprise
3.1 Quality and safety objectives in raw milk production

The objective of a dairy farmer is to produce quality and safe raw milk. This refers to milk that has been obtained from healthy dairy animals under hygienic conditions. It is:

(a) Wholesome, has no added water, preservatives, or other added substances and no natural constituent has been removed
(b) Free of extraneous matters like dust, dirt, flies and manure.
(c) Has a normal composition, possesses a natural milk sensory attributes such as flavor and color and is low in bacterial counts
(d) Is free from hazardous residues such as toxins and veterinary drugs and chemical contaminants
(e) Has a high keeping quality
(f) Has a high commercial value
Figure 5: Milking should be carried out under hygienic conditions to ensure wholesomeness of milk

Adulteration of raw milk by addition of water, chemicals and other substances or by removal of natural constituents is prohibited.

Precautions should be taken to ensure that raw milk is free from residues of veterinary drugs used in treatment of milking animals.

The safe handling of raw milk is based universally on the following two principles:

I. Avoiding or minimizing contamination at the various stages of producing and handling of the milk
II. Reducing the growth and activity of the micro-organisms in raw milk

Milk is virtually sterile when synthesized in the udder of a healthy cow. However, contamination with micro-organisms occurs during and after milking. Some of these may be harmful to humans while others cause the spoilage of milk. Temperature plays an important role in bacterial multiplication and therefore milk should be cooled within two hours of milking.
Figure 6: Major sources of contamination of milk at the farm

Contamination of raw milk at the farm occurs during milking and handling. The sources of contamination include:
- The milking animal
- Personnel
- Equipment
- Environment
- Water

3.2 Regulatory requirements for raw milk production

The requirements for raw milk production are stipulated in various Kenyan food legislations which include:

(a) Laws and regulations

- Public Health Act Cap 242
- Dairy industry Act Cap 336
- Food, Drugs and Chemical Substances Act Cap 254
- Standards Act Cap 496
- Animal Diseases Act Cap 364

(b) Standards and code of practice

Of relevance to milk production are the following Kenyan standards and code:

- Specifications for drinking (potable water) - KS EAS 12: 2014
In general, the above laws, regulations and standards require a dairy farmer to observe or comply with the following requirements:

(a) **Rear healthy dairy animals**

Dairy farmers are required to provide dairy animals with proper housing, feeding, treatment and healthcare among others. Treatment of sick animals should be undertaken by qualified veterinarians. Dairy animals should be free from brucellosis, tuberculosis and mastitis or any zoonotic disease. The animals should not show visible impairment of the general state of health. Diseased animals are also required to be isolated from the healthy herd.

The animal holding area should not adversely influence the health of the animals and should be kept clean, free of accumulation of manure, mud or any other objectionable materials. Cattle pens should be designed and constructed so as to keep them free of accumulation of manure, feed residues and easy to clean, drain and disinfect.

(b) **Hygienic milk production**

Raw milk shall be produced under conditions that minimize contamination from the animal, environment, personnel, feeds, equipment and related facilities.

(c) **Certification of milk handlers**

Milking personnel should observe good personal hygiene that minimizes the likelihood of contaminating the milk. They should be free from communicable diseases and medically certified. The milkers should undergo some basic training on hygiene milking.
(d) Wholesomeness of raw milk

Raw milk is the normal, clean and fresh secretion extracted from the udder of a healthy cow, properly fed and kept, but excluding that got during the first seven days after calving. It shall not contain added water, preservatives, or other added substances, nor shall any proportion of a natural constituent be removed. Sick animals can transmit zoonotic diseases to human beings through the milk.

Figure 8: Zoonotic diseases that can be transmitted to humans through milk

The health of dairy animals is an important consideration as certain diseases of cattle can be transmitted to milk either directly from the udder or indirectly through the infected body discharges, which may drop, splash or be blown into milk. These include:

- Tuberculosis
- Brucellosis
- Salmonellosis
Raw milk shall comply with the following among others (it should be noted that standards are dynamic and may change from time to time. Milk dealers are advised to keep abreast with revisions of the relevant standards).

- Minimum of 3.25 % milk fat and 8.50 % milk solids not fat.
- Density at 20 °C shall be within the range of 1.028 g/ml – 1.036 g/ml
- Low bacterial counts not exceeding 2,000,000 CFU/ml
- Low coliform counts not exceeding 50,000 cfu/ml
- Low somatic cell count not exceeding 300 000 per ml
- Be free from pesticides and veterinary drugs residues
- Be free from toxins e.g. aflatoxin M1

In addition, the raw milk should:

- Have a characteristic creamy–white color, free from off flavors and taints
- Be free of objectionable matter
- Not coagulate on the clot on boiling test
- Test negative to the alcohol test
- Test negative for presence of hydrogen peroxide

The somatic cell count in raw milk is a good indicator of mastitis infection in dairy animals.
(e) Registration and licensing of primary milk producers

All dairy farms producing milk for sale are required to be registered and issued with a registration certificate and licence where applicable such as the Food Hygiene License by Public Health Department and Primary Produce License by Kenya Dairy Board.

Figure 10: Benefits of registration and licensing

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<thead>
<tr>
<th>Why registration and licensing of dairy farms?</th>
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<tr>
<td>• For compliance</td>
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<tr>
<td>• Facilitates periodic inspection of production facility</td>
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<td>• For traceability of products</td>
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<td>• For certification of products</td>
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<td>• Builds consumer confidence in product</td>
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CHAPTER FOUR: APPLICATION OF QUALITY ASSURANCE IN RAW MILK PRODUCTION

4.1 Introduction
The quality and safety of raw milk is influenced by many factors including animal health, feeding, environment, personnel, milking practice, equipment and utensils and cleaning and sanitization procedures.

Figure 11: Some of the factors affecting the quality of raw milk
Milking areas should only accommodate the milking animals. Premises where milking is performed should be sited and constructed in such a way as to minimize the risk of environmental contamination of the milk.

Training of personnel involved in milk production and handling is important in developing the necessary skills to support the implementation of the QAS.

Adoption of a robust Quality Assurance System will therefore focus on the whole production process which can be categorized into three broad stages:

(a) **Pre-milking**
(b) **Milking**
(c) **Handling and storage**

In each of the three areas, the following Quality Assurance Practices are recommended.

**4.2 Application of Quality Assurance in pre-milking**

A lot of preparation is required before the actual milking is conducted. Milking should be conducted under hygienic conditions and therefore focus should be on ensuring that possible sources of contamination from the environment (e.g. dust and waste), the health of the animal, feeds and feeding, personnel and equipment are controlled
### Table 1: Recommended QA practices in pre-milking stage

<table>
<thead>
<tr>
<th>Factors to consider</th>
<th>Risk element</th>
<th>Requirements</th>
<th>Monitoring mechanism</th>
<th>Remedial action (when requirements are not met)</th>
<th>Records</th>
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<tbody>
<tr>
<td>1. Environment</td>
<td>Water</td>
<td>Adequate and clean potable water should be provided for feeding of dairy animals and cleaning of equipment</td>
<td>Physical inspection of water for absence of foreign matter, suspended particles, organisms and other unwanted physical matter</td>
<td>Water treatment (sedimentation, filtration and chlorination etc.)</td>
<td>Water treatment records</td>
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<td>Laboratory testing of water</td>
<td>Protect water sources from possible sources of contamination</td>
<td>Find alternative sources of water</td>
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<td>Waste</td>
<td>Proper disposal of waste to prevent breeding of pests and rodents and bacteria in and around the milking area</td>
<td>Physical inspection of milking areas and surroundings</td>
<td>Removal and disposal of wastes and effluent in milking and surrounding areas</td>
<td>Implement insect and rodent control programs</td>
<td>Insect and rodent control records</td>
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<td></td>
<td>Latrines should be provided and located away from milking areas to avoid contamination</td>
<td>Physical inspection of milking areas and surroundings</td>
<td>Provide clean toilets located away from milking areas</td>
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<td>Dust</td>
<td>The milking areas and surroundings should be free of dust</td>
<td>Physical inspection of milking areas and surroundings</td>
<td>Remove the dust</td>
<td>Control the source of the dust</td>
<td>Relocate the milking area</td>
</tr>
<tr>
<td>Factors to consider</td>
<td>Risk element</td>
<td>Requirements</td>
<td>Monitoring mechanism</td>
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<td>2. Animal Health</td>
<td>Zoonotic diseases</td>
<td>Dairy animals should be free from brucellosis, tuberculosis and mastitis or any other zoonotic disease</td>
<td>Physical inspection of the udder and the general health condition of the animal</td>
<td>Diagnosis and treatment by a Veterinary Doctor</td>
<td>Animal treatment records</td>
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<td>Rejection and disposal of affected milk</td>
<td>Milk disposal records</td>
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<td></td>
<td>Separate diseased animals from healthy animals</td>
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<td></td>
<td></td>
<td>Separate milking from non-milking animals</td>
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<td>Veterinary drugs</td>
<td>Milk from animals, which have been treated with antibiotics, or other veterinary drugs should not be consumed until the end of the specified withdrawal period</td>
<td>Treatment history of the animal</td>
<td>Reject and dispose affected milk</td>
<td>Ensure appropriate storage conditions of feed and fodder to avoid spoilage or contamination</td>
<td>Animal treatment records</td>
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<td></td>
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<td></td>
<td>Observe withdrawal periods as specified by the Veterinary Doctor</td>
<td>Milk disposal records</td>
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<td>3. Feeds and feeding</td>
<td>Feeds</td>
<td>Forage, feed and fodder should be safe and suitable and should not present a risk of transferring pathogens, residues of pesticides, toxins or any other agent to the milk in amounts that present a health risk to consumers</td>
<td>Physical inspection of feed and fodder for evidence of spoilage</td>
<td>Ensure appropriate storage conditions of feed and fodder to avoid spoilage or contamination</td>
<td>Test records for aflatoxin B1 and pesticides residuals</td>
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<td>Testing of feeds and fodder for presence of aflatoxin B1</td>
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<td>Reject moldy or sub-standard feeds and fodder</td>
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<td>Testing feeds and fodder for pesticide residues</td>
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<td>Ensure chemicals are used appropriately on pastures and</td>
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<td>Factors to consider</td>
<td>Risk element</td>
<td>Requirements</td>
<td>Monitoring mechanism</td>
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<td>4. Personnel</td>
<td>Contagious diseases</td>
<td>Milking personnel should be free of contagious or infectious diseases which may be transferred through the milk or affect the quality of the milk</td>
<td>Physical inspection of milking personnel</td>
<td>Relieve infected personnel from milking and milk handling duties</td>
<td>Valid medical certificates</td>
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<td></td>
<td>Contaminatio n of the milk</td>
<td>Milkers and milk handling personnel should observe personal hygiene, wear suitable protective attire and avoid undesirable behavior during milking</td>
<td>Physical inspection of milkers and milk handlers</td>
<td>Develop and implement a code of conduct or personal hygiene rules for milk handlers</td>
<td>Code of conduct for the milk handlers</td>
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<td></td>
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<td></td>
<td>Medical examination of personnel by a certified medical examiner</td>
<td>Sensitize milk handlers on hygiene requirements</td>
<td>Personal hygiene rules</td>
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<td></td>
<td>Provide adequate and appropriate sanitary facilities including protective clothing and hand washing</td>
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<td>Factors to consider</td>
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<td>Requirements</td>
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</tr>
<tr>
<td>5. Equipment, containers and utensils</td>
<td>Contamination of the milk</td>
<td>The surfaces of equipment and utensils which come into contact with milk should be easy to clean and disinfect, corrosion resistant and not capable of transferring harmful substances to the milk which can cause health risks to consumers</td>
<td>Physical inspection of the equipment and utensils</td>
<td>Dispose and replace unsuitable equipment and utensils</td>
<td>Store equipment, utensils and containers under conditions that prevent contamination</td>
</tr>
<tr>
<td></td>
<td>Contamination of the milk</td>
<td>Milking equipment and utensils should be cleaned and disinfected using appropriate agents after each milking</td>
<td>Physical inspection of the equipment and utensils</td>
<td>Develop and implement a cleaning and sanitization schedule for equipment and utensils</td>
<td>Identify and use effective cleaning and sanitization agents</td>
</tr>
<tr>
<td>6. Milking parlor</td>
<td>Contamination of milk</td>
<td>Impervious and free draining floor</td>
<td>Physical inspection of the milking parlour</td>
<td>Renovate floor and drainage system</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Contamination of milk</td>
<td>Should have adequate lighting and ventilation</td>
<td>Physical inspection of milking parlour</td>
<td>Provide adequate lighting</td>
<td>-</td>
</tr>
<tr>
<td>Factors to consider</td>
<td>Risk element</td>
<td>Requirements</td>
<td>Monitoring mechanism</td>
<td>Remedial action (when requirements are not met)</td>
<td>Records</td>
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<tr>
<td></td>
<td>Contamination of milk</td>
<td>Surroundings should be maintained in a neat and clean condition, free of harborages and breeding areas</td>
<td>Physical inspection of milking parlour</td>
<td>Manage manure and other wastes from the milking area and related facilities</td>
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<td></td>
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<td>Improve drainage system</td>
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<td>Relocate the milking parlor</td>
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<td></td>
<td>Keep the surrounding neat by trimming grass and cutting unwanted bushes</td>
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</tbody>
</table>

**Figure 12: Personal hygiene tips for milk handlers**

Milk handling personnel should maintain high degree of personal hygiene and be equipped with appropriate work attire. They should:

- Wear neat and clean protective attire
- Wear clean safety boots
- Avoid wearing wrist watches, rings, earing, necklace or chain
- Hair should be trimmed and tucked inside the cap
- Cover all open wounds
**Figure 13: Effective hand washing procedures**

**Effective hand washing procedure**
- Moisten hands with water and apply soap
- Rub hands together vigorously until a soapy lather appears, and continue for at least twenty seconds
- Rub areas between fingers, around nail beds, under fingernails, and back of hands.
- Rinse hands under running water, until they are free of soap and dirt.
- Dry hands with the clean, disposable paper or single use cloth towels

**Figure 14: Procedure for cleaning milk cans**

Immediately cans are emptied of milk they should be cleaned and disinfected.

**Procedure for cleaning of milk cans**
- Rinse with cold water
- Scrub with brush and detergent
- Rinse with cold water
- Sterilize with boiling water, steam or approved sanitizers
- Dry cans on a drying rack
Figure 15: Cleaning of milking machines

Milking machines should be cleaned according to the practice recommended by the manufacturer or supplier. Generally the procedure involves:

![Cleaning of milking machines]

- Rinse with cold water
- CIP (Cleaning in Place) using detergent and hot water
- Rinsing with hot water

4.3 Milking

Whether by hand or machine, milking should be conducted under hygienic conditions using best milking practices that will not contaminate the milk or injure the teats and udder. It’s recommended that the following are observed:

- At the start of milking, the foremilk (initially drawn small quantity of milk) from each teat should be discarded or collected separately and not used for human consumption as it has a heavy load of spoilage micro-organisms.
- Milk obtained during the first seven days of calving should be handled separately and not mixed with normal milk.
- Brushing of animals at the time of milking shall be avoided, as it is likely to raise dust in the milking area.
- If the animals are fed during milking, the method of feeding and the type of feed used should not be a source of contamination to the milk
- The milk should be drawn directly into the milking container as fast as possible
- The milkers should not wipe their hands on the body of the animals or on their person. The switch of the tail should not be touched
- Where milk is soiled with dung, dirt or urine from the animal, such milk should be separated and discarded
- In machine milking, regular cleaning, sanitization and maintenance should be carried out as recommended by the manufacturer or supplier

**Figure 16: Teat dipping**

Post-milking teat dipping is essential to control the spread of mastitis during milking. The entire surface of each teat needs to be thoroughly coated after each milking throughout the lactation period. Teat dip solutions should be used as recommended by the manufacturer.

**Table 2: Recommended QA practices in milking stage**

<table>
<thead>
<tr>
<th>Factors to consider</th>
<th>Risk element</th>
<th>Requirements</th>
<th>Monitoring mechanism</th>
<th>Remedial action (when requirements are not met)</th>
<th>Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hygienic milking</td>
<td>Contaminati  on of the milk</td>
<td>Animals showing clinical symptoms of diseases transferable to humans through the milk should be segregated and milked separately and the milk</td>
<td>Physical inspection of milking animals Diagnosis and treatment by a certified Veterinarian</td>
<td>Segregation of sick animals and disposal of their milk Diagnosis and treatment of sick animals</td>
<td>Animal treatment records Milk disposal records</td>
</tr>
<tr>
<td>Factors to consider</td>
<td>Risk element</td>
<td>Requirements</td>
<td>Monitoring mechanism</td>
<td>Remedial action (when requirements are not met)</td>
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<tr>
<td></td>
<td></td>
<td>should not be used for human consumption</td>
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</table>
|                     |              | The udder and teats of the milking animal should be effectively cleaned with potable water and dried with a clean towel, one for each animal | Physical inspection of the cleanliness of the udder and teats | Repeat cleaning where the cleaning is not adequate  
Provide one towel per animal |                               |
|                     |              | Check milk from each teat for visible defects including mastitis              | Testing for mastitis and other visible defects            | Animals with symptoms of mastitis should be milked last and discard abnormal milk  
Complete emptying of the udder during milking  
Diagnosis and treatment of sick animals  
Disinfect teats with teat dip after milking | Mastitis test records  
Results of somatic cell counts  
Milk disposal records  
Animal treatment records |
The California Mastitis Test (CMT) and strip cup are commonly used to test for mastitis in milking animals. Mastitis affects productivity of the cow and composition and quality of the milk.

4.4 Handling and storage

After milking, the milk should be immediately stored in clean sealed containers under conditions preventing contamination or transported to the collection center within two hours of milking. Where the milk is stored for a longer time at the farm, cooling to four degrees centigrade within two hours is required.
Figure 18: Bacteria rapidly multiply when milk is stored under high temperatures

Table 3: Recommended QA practices in milk handling and storage

<table>
<thead>
<tr>
<th>Factors to consider</th>
<th>Risk element</th>
<th>Requirements</th>
<th>Monitoring mechanism</th>
<th>Remedial action (when requirements are not met)</th>
<th>Records</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Storage containers and tanks</strong></td>
<td>Contaminatio n of the milk</td>
<td>The surfaces of the storage container which come into contact with milk should not contaminate the milk with harmful substances</td>
<td>Physical inspection of the containers Rinse and swab tests of milk storage containers</td>
<td>Replacing unsuitable containers Cleaning and sanitization of milk containers and tanks prior to filling</td>
<td>Equipment cleaning records Maintenance records for cooling tanks Rinse and swab tests</td>
</tr>
<tr>
<td>Factors to consider</td>
<td>Risk element</td>
<td>Requirements</td>
<td>Monitoring mechanism</td>
<td>Remedial action (when requirements are not met)</td>
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</tr>
<tr>
<td>2 Storage temperature and time</td>
<td>Milk spoilage</td>
<td>Raw milk should be cooled to four degrees centigrade within two hours of milking</td>
<td>Monitoring of temperature and time during storage of milk</td>
<td>Immediately deliver the milk to the nearest milk cooling center</td>
<td>Temperature and time records</td>
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<tr>
<td></td>
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<td></td>
<td>Repair or replace faulty milk cooling equipment</td>
<td>Calibration records</td>
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<td></td>
<td></td>
<td></td>
<td>Calibration of temperature and time measuring instruments</td>
<td></td>
</tr>
<tr>
<td>3 Storage environment</td>
<td>Contaminatio n of the milk</td>
<td>Premises for storage of milk should be situated and constructed in such a manner as to avoid risk of contaminating the milk</td>
<td>Physical inspection of storage environment for suitability and cleanliness</td>
<td>Keep storage premises neat and clean</td>
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<td></td>
<td>Relocate milk storage premise</td>
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<td></td>
<td></td>
<td></td>
<td>Renovate milk storage premise</td>
<td></td>
</tr>
<tr>
<td>4 Wholesome -ness of the milk</td>
<td>Adulteration of the milk</td>
<td>Milk should not contain added water, preservatives, or other added substances, nor should any proportion of a natural constituent be removed.</td>
<td>Testing of raw milk (Organoleptic, lactometer, alcohol tests etc.)</td>
<td>Disposal of the affected milk</td>
<td>Test records for the milk</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Seek extension advise if milk is unwholesome</td>
<td></td>
</tr>
<tr>
<td>Factors to consider</td>
<td>Risk element</td>
<td>Requirements</td>
<td>Monitoring mechanism</td>
<td>Remedial action (when requirements are not met)</td>
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</table>

<p>| Table 4: Tests that can be conducted at the farm |
|-----------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| <strong>Type of test</strong>                          | <strong>Procedure</strong>                                    | <strong>Judgement</strong>                                    |
| (a) <strong>Organoleptic test</strong>                  | - Open a can of milk                             | Discard milk that has abnormal smell and has visible dirt |
|                                          | - Immediately smell the milk                     |                                                 |
|                                          | - Observe the appearance of the milk             |                                                 |
|                                          | - Check the can and lid for cleanliness          |                                                 |
| (b) <strong>The Lactometer test</strong>                | - Mix the milk sample gently and pour it gently into a measuring cylinder | Discard milk that has a density below 1.028g/ml and that above 1.036g/ml |
|                                          | - Let the lactometer sink slowly into the milk.  |                                                 |
|                                          | - Read and record the last Lactometer degree (ºL) just above the surface of the milk. |                                                 |
|                                          | - If the temperature of the milk is different from the calibration temperature of the lactometer (usually 20 degrees centigrade), calculate the temperature correction |                                                 |
|                                          | - For each degree centigrade above the calibration temperature add 0.2ºL; for each degree centigrade below calibration temperature subtract 0.2 ºL from the recorded lactometer reading |                                                 |
| (c) <strong>The Alcohol Test</strong>                   | - Mix equal amounts of milk and 68% of ethanol solution | If milk is of good quality, there will be no |</p>
<table>
<thead>
<tr>
<th>Type of test</th>
<th>Procedure</th>
<th>Judgement</th>
</tr>
</thead>
<tbody>
<tr>
<td>simple. It is based on</td>
<td>in a small bottle or test tube.</td>
<td>coagulation, clotting or</td>
</tr>
<tr>
<td>instability of the milk</td>
<td>- Observe the milk for</td>
<td>precipitation,</td>
</tr>
<tr>
<td>proteins</td>
<td>coagulation</td>
<td></td>
</tr>
</tbody>
</table>

In addition, dairy farmers can use external laboratories to conduct other tests for milk and feed e.g. on contaminants and veterinary drugs residues
CHAPTER 4: SELF-ASSESSMENT
GUIDELINES FOR QUALITY AND SAFE RAW MILK PRODUCTION

In order to evaluate whether the milk production Quality Assurance System is effectively in place and working as desired, it is critical to routinely conduct a self-assessment.

Self-assessment is a rapid tool for internal appraisal that can give reliable results on the performance of the QAS. This evaluation will provide a framework and input to regulatory surveillance and support. It also provides a mechanism for continuous improvement of the QAS.

The tool promotes confidence build up for market access and elevates the dairy farm profile as a reliable source of quality and safe raw milk.

This can be done using a simple checklist as recommended below provided in table 5 below;

When conducting the self-assessment, the following procedure is proposed:

- Determine the best time to conduct the self-assessment based on the operations of the farm
- Prepare for the self-assessment by assembling the required materials and documentation such as records and self-assessment checklist
- Wear appropriate and clean attire especially when inspecting areas prone to contamination such as the milking parlor
- Refer to the results of the previous self-assessment records to note areas of non-compliances and remedial action taken
- Follow a process approach by walking through the sequential steps involved in raw milk production.
- Conduct interviews with farm workers where necessary to get more insight on the practices in the farm.
- Record observations in the self-assessment checklist and make any other relevant observations that may not be provided in the checklist.
- Evaluate findings at the end of the self-assessment and address areas of non-compliances.

**Table 5: Self-assessment guideline for milk production**

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Requirements</th>
<th>Assessment criteria</th>
<th>Requirements met?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Physical inspection of water sources</td>
<td></td>
</tr>
<tr>
<td>1. Pre-milking stage of production</td>
<td></td>
<td>Laboratory testing of the water</td>
<td></td>
</tr>
<tr>
<td>1.1 Potable water</td>
<td>Availability of adequate and clean potable water</td>
<td>Physical inspection of water sources</td>
<td></td>
</tr>
<tr>
<td>1.2 Waste management</td>
<td>Waste disposed in a manner to prevent contamination of milk</td>
<td>Physical inspection of milking areas</td>
<td></td>
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<tr>
<td></td>
<td>Adequate and appropriately located toilet facilities provided</td>
<td>Physical inspection of toilet facilities</td>
<td></td>
</tr>
<tr>
<td>1.3 Dust management</td>
<td>Milk production areas and surroundings free of dust</td>
<td>Physical inspection of milking areas</td>
<td></td>
</tr>
<tr>
<td>1.4 Animal health management</td>
<td>Dairy animals free from zoonotic diseases</td>
<td>Physical inspection of animals</td>
<td></td>
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<tr>
<td></td>
<td>Sick animals are examined and treated by qualified veterinarian</td>
<td></td>
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<tr>
<td></td>
<td>Milk free from antibiotics and other veterinary drugs</td>
<td>Testing for antibiotics and veterinary drugs residues are conducted</td>
<td></td>
</tr>
<tr>
<td>1.5 Feeds and</td>
<td>Forage, feed and fodder safe and free</td>
<td>Testing for pesticide</td>
<td></td>
</tr>
<tr>
<td>Consideration</td>
<td>Requirements</td>
<td>Assessment criteria</td>
<td></td>
</tr>
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</tr>
<tr>
<td>Feeding</td>
<td>of pathogens, pesticide and toxin residues in excess of allowable limits</td>
<td>residues and aflatoxins conducted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feeds are stored under recommended conditions</td>
<td>Physical inspection of feed storage areas</td>
<td></td>
</tr>
<tr>
<td>1.6 Personnel</td>
<td>Milking personnel are free of contagious or infectious diseases</td>
<td>Medical examination of milk handlers conducted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Milkers and milk handlers observe appropriate personal hygiene and conduct</td>
<td>Physical examination of milk handlers</td>
<td></td>
</tr>
<tr>
<td>1.7 Equipment, containers and utensils</td>
<td>Equipment, utensils and containers are clean and suitable for handling milk</td>
<td>Physical inspection of equipment, containers and utensils</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cleaning and sanitization conducted using appropriate agents</td>
<td>Physical inspection of cleaning and sanitization agents</td>
<td></td>
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<tr>
<td></td>
<td>Cleaning schedule in place and Implemented</td>
<td>Cleaning schedule in place and Implemented</td>
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</tr>
<tr>
<td>1.8 Milking parlor</td>
<td>Floor is impervious and self-draining</td>
<td>Physical inspection of milking parlour</td>
<td></td>
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<tr>
<td></td>
<td>Has adequate lighting and ventilation</td>
<td>Physical inspection of milking parlour</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surroundings are neat and clean and free of waste and effluent</td>
<td>Physical inspection of milking parlour</td>
<td></td>
</tr>
</tbody>
</table>

2. Milking

2.1 Hygienic milking

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Assessment criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals showing clinical signs of diseases are segregated and milked separately</td>
<td>Physical inspection of milking process</td>
</tr>
<tr>
<td>Udder and teats are effectively cleaned and dried at the time of milking</td>
<td>Physical inspection of milking process</td>
</tr>
<tr>
<td>Teats free of visible defects including mastitis</td>
<td>Physical inspection of milking process</td>
</tr>
<tr>
<td>Consideration</td>
<td>Requirements</td>
</tr>
<tr>
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</table>

### 3. Handling and storage

<table>
<thead>
<tr>
<th>3.1 Storage containers and tanks</th>
<th>Storage containers are clean and do not contaminate milk</th>
<th>Physical inspection of storage containers</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2 Storage temperature and time</td>
<td>Milk is cooled to four degrees centigrade within two hours</td>
<td>Temperature and time analysis of stored milk</td>
<td>Yes/No</td>
</tr>
<tr>
<td>3.3 Storage environment</td>
<td>Milk storage premises is suitably located and constructed to avoid risk of contaminating the milk</td>
<td>Physical inspection of milk storage premises</td>
<td>Yes/No</td>
</tr>
<tr>
<td>3.4 Wholesomeness of the milk</td>
<td>Milk is wholesome and does not contain added water, preservatives, or other substances</td>
<td>Organoleptic test is conducted</td>
<td>Yes/No</td>
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<td></td>
<td></td>
<td>Lactometer test is conducted</td>
<td>Yes/No</td>
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</tbody>
</table>

### 4. Customer feedback

| 4.1 Handling of customer feedback and complaints | There is a mechanism to receive and respond to customer complaints or feedback | Physical verification | Yes/No |
|                                                 | Customer complaints are addressed on time                 | Physical verification | Yes/No |
## Equipment maintenance schedule

**Name of the farm**

Date: ____________________________________________________________

Prepared by: ______________________________________________________

Submitted by: _____________________________________________________

Approved by: _____________________________________________________

<table>
<thead>
<tr>
<th>Equipment No.</th>
<th>Task description</th>
<th>Task duration</th>
<th>Due date</th>
<th>Target date</th>
<th>Resource name</th>
<th>Person responsible</th>
<th>Predecessor</th>
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</table>

## Cleaning schedule

<table>
<thead>
<tr>
<th>Section</th>
<th>Frequency</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
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</tbody>
</table>
REFERENCES

a) Public Health Act Cap 242, laws of Kenya
b) Food, Drugs and Chemical Substances Act Cap 254, laws of Kenya
c) Dairy Industry Act Cap 336, laws of Kenya
d) Draft Dairy Regulations 2017
e) Standards Act Cap 496, laws of Kenya
g) Code of hygienic practice for milk and milk products
h) FAO and IDF, 2011. Guide to good dairy farming practice
j) FAO. Milk processing Guide Series, Volume 2
Smallholder Dairy Commercialization Programme (SDCP) is a jointly funded programme by the Government of the Republic of Kenya (GOK) and the International Fund for Agricultural Development (IFAD) and beneficiary communities.

The Overall goal of the programme is to increase the income of poor rural households that depend substantially on production and trade of dairy products for their livelihood.